Chronic Obstructive Pulmonary Disease in Combination with Cardiovascular Diseases

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Abstract: COPD is one of the most common chronic lung diseases, affecting more than 200 million people worldwide, and is the third leading cause of death in the world after heart attack and stroke. This article discusses a chronic obstructive pulmonary disease in combination with cardiovascular diseases.

Keywords: chronic obstructive pulmonary disease, arterial hypertension, coronary heart disease.

Introduction: The comorbid background of patients with chronic obstructive pulmonary disease (COPD) is burdened by no less than the somatic status of "vascular" patients, while it is obvious that COPD, in turn, but in a number of clinical and laboratory parameters aggravates the clinical course of the vast majority of diseases known today. Evidence of this postulate can be found in the epidemiological work of domestic and foreign therapists and pulmonologists.

The results of these study, demonstrate data according to which in patients with COPD:

- in 85% of cases there is hypertension with damage to target organs;
- 64% of patients have coronary atherosclerosis;
- in 19% of cases, a network history of an ischemic stroke;
- in 21% of cases, the diagnosis of pulmonary embolism is confirmed;
- 39% of patients have excessively developed fatty tissue;
- 14% of patients have severe underweight;
- in 27% of cases, malignant neoplasms of different localizations are diagnosed;
- in 34% of cases there is benign prostatic hyperplasia;
- 67% of patients have a decrease in bone mineral density, etc. [2]

According to some authors, the presence of comorbidity against the background of COPD is the rule rather than the exception, because. 96.4% of COPD patients aged 45 years and older have at least one concomitant disease that affects the treatment of this bronchopulmonary pathology [2, 7].

At the annual ERS congress in 2009, researchers from the UK J. Feary. N. Barnes presented the results of research on The Health Improvement Network, a computer database that combines more than 5 million patient records. According to this study, COPD patients are 5 times more likely to have a diagnosis of cardiovascular disease ; in the group of 35 to 45 years old, patients with COPD are 7.6 times more likely to have comorbid cardiovascular pathology ; in young patients with COPD, the risk of developing myocardial infarction increases 12 times.

Cardiovascular disease (CVD) is the most common cause of death in most developed countries. CVD of atherosclerotic genesis is a chronic disease that develops latently throughout life and is manifested by a detailed pathogen etic picture by the time symptoms appear.

Currently, COPD is considered as a systemic disease, with a stable course of which indicators such as the level of circulating leukocytes are determined. C-reactive protein (CRP), IL-6, 1L-8, TNF-α, fibrinogen. It is known that the risk of cardiovascular diseases increases with chronic inflammatory processes. In particular, in COPD, there is a direct relationship between the magnitude of the systemic inflammatory response and arterial stiffness. It is also known that acute cardiovascular events are a common cause of death in patients with COPD, while in patients with COPD, a decrease in FEV1 by 10% increases cardiovascular mortality by 28% [1, 8].

How does systemic inflammation in COPD contribute to the development of cardiovascular disease? The provoking factor of exacerbations of COPD is usually an episode of tracheobronchial viral or bacterial infection, which inevitably leads to activation of inflammation in the airways. Further activation occurs granulocytic ally- macrophage colony-stimulating factor, growth and differentiation of maculocytes. macrophages that provide inflammatory reactions in tissues. Activation of Il -6 and fibrinogen leads to increased coagulation, instability of the autonomic nervous system - to arrhythmias; an increased amount of TNF-α and C-reactive protein - to the progression of atherosclerosis.

The purpose of the study: to study combination of cardiovascular diseases in patients with chronic obstructive pulmonary disease.

Materials and methods of research: in order to solve the set tasks, we examined 65 patients diagnosed with cardiovascular diseases.

Results of the study: The main variants of cardiovascular diseases in COPD are coronary heart disease (CHD), arterial hypertension (AH) and heart failure (HF). The results of our studies, the incidence of COPD and coronary artery disease in patients of older age groups - 62%.the mortality rate for a combination of these two pathologies is more than 50%. In patients with newly diagnosed COPD, the frequency of myocardial infarction is 5.5 times higher than in the population, the frequency of stroke is 3.3 times higher; there is an increase in hospital mortality in patients with heart failure, and up to 20% of patients with identified COPD had previously undiagnosed heart failure [2,7,8].

Arterial hypertension in patients with COPD is one of the frequent comorbid conditions in the clinic of internal diseases, which is the subject of constructive interaction between internists, cardiologists, and pulmonologists. AH is detected in patients with COPD with different frequency (from 6.8% to 76.3%), averaging 34.3%. There are two points of view on the combination of hypertension and COPD: the presence of two independent diseases in elderly patients; COPD is the cause of the development of AH, which gives reason to consider AH in this category of patients as symptomatic and even designate it as pulmogenic AH (but analogies with nephrogenic, endocrine, etc.) In any case, taking into account two points of view on mutual coexistence Hypertension and COPD, the presence of hypoxia in COPD aggravates the severity and contributes to the progression of existing hypertension, or contributes to the development of symptomatic hypertension [2,4].

Patients with a combination of arterial hypertension and COPD are characterized by a higher heart rate, more frequent development of kidney damage and a higher risk of cardiovascular complications with a blood pressure (BP) value comparable to patients with hypertension without COPD. Arterial hypertension in patients with COPD is characterized by an earlier

manifestation, a higher degree of blood pressure increase, accompanied in a greater percentage of cases by damage to target organs, which generally increases the risk of cardiovascular complications. The widespread introduction into clinical practice of such research methods as Holter monitoring, ultrasound examination of the heart, stress testing, made it possible to establish that chronic obstructive pulmonary disease should be considered as a factor that increases the risk of developing coronary artery disease by 2-3 times. The compatibility of coronary artery disease and COPD, according to various studies, in older age groups reaches 62%, and the 15-year survival rate of such patients is no more than 25% [1,2,6].

The main pathogen etic factors that combine such pathological processes as COPD and IHD are that smoking and free radical oxidation. Age-related morph functional changes in the respiratory and cardiovascular systems should also be taken into account. Smoking is the main factor of exogenous damaging effects on the respiratory tract, leading to the development of COPD. Tobacco smoke contains about 4700 different toxic substances that deplete the protective antioxidant and ant protease functions of the respiratory organs. This contributes to the activation of free radical processes not only in the lungs, but also in the systemic circulation. Over time, a chronic inflammatory process develops in the airways, including with the participation of microbial flora. The long course of the inflammatory process is accompanied by the formation and entry into the general circulation of inflammatory mediators: prostaglandins, leukotriene’s. Interleukins, tumor necrosis factor, etc. Systemic action of inflammatory mediators is accompanied by activation of free radical oxidation processes [2,3,5]. The impact of free radicals on the vascular wall leads to the activation of the process of lipid peroxidation (LPO) of cell membranes, disruption of the receptor function of the endothelium. These processes contribute to a decrease in the efficiency of low-density lipoprotein (LDL) utilization by the endothelium and their penetration into the sub endothelial layer. In the sub endothelial layer, LDL is captured by macrophages, which gradually turn into foam cells, giving rise to atherosclerotic plaque formation. The action of free radicals on LDL leads to the modification of their protein part - Apo protein. Modified LDL is not recognized by endothelial receptors, their concentration in the blood increases.

When analyzing the combination of COPD and heart rhythm disturbances, it is found that with long-term ECG recording in COPD patients, heart rhythm disturbances are recorded in 79-92% of cases: with a stress test (treadmill), their frequency reaches 100%, with a combination of COPD and IHD, heart rhythm disturbances are observed with an even higher frequency - from 80.1 to 96.7% [1].

One of the important risk factors for the development of cardiovascular diseases is obesity. It is now well known that obesity is a state of systemic inflammatory response, and adipose tissue is not an inert substance, but an actively secreting source of pro-inflammatory mediators (adipokines), such as C-reactive protein, tumor necrosis factor α (TNF-α), interleukins (IL-4, IL-5 I L-6, IL-I3), plasminogen activator inhibitor, vascular endothelial growth factor, monocyte chemotaxis protein. Adipokine levels increase in proportion to BMI and are also associated with the development of non-insulin dependent diabetes mellitus and atherosclerosis.

In obesity, the synthesis of the anti-inflammatory cytokine adnonectinand I L-10 is inhibited. Obesity is accompanied by oxidative stress, as evidenced by an increase in the level of 8-isoprostane and other markers both in the blood and in the lungs as the body mass index increases [2]. The peculiarity of the metabolism of adipose tissue in overweight makes a significant contribution to the state of systemic inflammation. The accumulation of fat is

ahead of angiogenesis and is accompanied by an increase in the distance between adiposites and capillaries, so the adipose tissue undergoes a state of local ischemia.

In ischemic zones, individual cell death, active infiltration by macrophages, and synthesis of pro-inflammatory mediators, including TNF-α and IL-6, occur. In turn, hypoxia due to bronchospasm in COPD increases ischemia of adipose tissue and the degree of inflammation [1,3]. According to Schokke r et a l . (2007), 17% of COPD patients are obese. Even in the absence of primary pathology of the lungs, obesity, especially its abdominal type, has a profound pathophysiological effect on the respiratory system, disrupting ventilation function, respiratory mechanics, respiratory muscle strength and endurance, gas exchange, respiratory control, exercise tolerance, resulting in respiratory failure. .

Metabolic syndrome, including abdominal obesity, hyper dyslipidemia, arterial hypertension, impaired carbohydrate tolerance and / or insulin resistance, often associated with increased plasma coagulation potential and pro-inflammatory activation. Patients with COPD often have more than 1 sign of the metabolic syndrome or osteoporosis (in 70% of cases), which can have a negative impact on the physical activity of patients [1.5]. It should be noted that COPD can be considered as an independent marker of some components of the metabolic syndrome, such as reduced carbohydrate tolerance or type 2 diabetes mellitus, arterial hypertension, or a reduction in bone mineral density. Note that type 2 diabetes mellitus is often associated not only with arterial hypertension, abdominal obesity, various cardiovascular diseases, but also with impaired pulmonary function and a decrease in FEV1, worsening the clinical picture and evolution of COPD.

It should be noted that the intensity of systemic pro-inflammatory activation in COPD patients correlates well with the risk of metabolic syndrome and type 2 diabetes mellitus. It is noteworthy that in a cohort of patients with type 2 diabetes mellitus with concomitant COPD, higher concentrations of CRP, fibrinogen, IL-6, TNF [32] are observed, as well as the lowest level of plasma albumin, compared with people with obstructive pulmonary diseases, regardless of their gender and age [11, 13]. Thus, the metabolic syndrome/diabetes mellitus type 2 , on the one hand, as well as impaired bronchial patency and decreased lung function, on the other hand, can mutually potentiate each other [1,2].

Using the <90% ideal weight loss criterion, several epidemiological studies have found that underweight can be verified in 24–35% of patients with COPD. Moreover, the latter is also considered as an independent prognostic factor for a high risk of COPD [5].

In addition, in a cohort of patients with already documented COPD, underweight correlates with the likelihood of an adverse outcome even better than a reduction in FEV1 [2]. Systemic inflammatory activation is considered as the main cause of weight loss. Excessive production of cytokines, mainly IL-2 and IL-6, leads to a decrease in the secretion of adiponectin and leptin [2], which induces lipolysis and contributes to the formation of respiratory cachexia.

Anemia is a fairly common occurrence in patients with COPD. The existence of a relationship between the frequency of verification of anemia and respiratory cachexia was assumed [1,6]. In turn, M. John et al (2005) noted that 13% of patients with moderate and severe COPD without underweight have a high level of erythropoietin with low levels of hemoglobin and erythrocytes. According to the researchers, this may be due to the formation of resistance to erythropoietin due to a pronounced systemic pro-inflammatory activation, mainly by an excess pool of IL-6. At the same time, the authors of the study did not reveal a correlation between the severity of COPD, on the one hand, and the severity of anemic syndrome, body weight of patients, on the other.

If we take into account the epidemiological data on the incidence of osteoporosis and COPD.

then there is a clear trend towards an increase in the incidence rate with age. Therefore, it would seem that we can talk about the natural "age-related comorbidity" of COPD and osteoporosis. This factor is not in doubt, but the studies available on this issue show that a number of other reasons may play a role in the development of osteoporosis in patients with COPD. The main reasons for the development of osteoporosis in COPD are a chronic inflammatory process, an increase in the production of pro-inflammatory cytokines; hypoxia (bronchial obstruction, hypoventilation, and decrease in minute volume of breathing, circulatory failure), accumulation of CO2, lactic acid in the blood, chronic respiratory acidosis; application glucocorticoids; immobilization [2.3]. Osteoclasts (bone-destroying cells) originate from a monocyte-macrophage germ. The key mechanism of the relationship between bone tissue and the vascular wall is the role of tissue or circulating macrophage cells. In the arterial wall, macrophages play a key role in the development and progression of atherosclerotic plaques, while for bones, the degree of maturation of osteoclasts and their destruction of bone tissue is extremely important [8]. Low bone mineral density (BMD) is an independent risk factor for cardiovascular mortality in older men and women, more valuable than blood pressure and blood cholesterol levels [1]. In postmenopausal women, low-density lipoprotein (LDL) cholesterol levels are significantly inversely associated with BMD, suggesting that lipids and bone tissue “share factors that link osteoporosis and atherosclerosis” [2]. Calcification of the aorta and coronary arteries is common in the elderly and may be the basis of cardiovascular morbidity and mortality. Moreover, they are associated with signs of bone resorption and fractures of the spine [1,7].

Conclusions:

1) One of the leading clinical problems for patients with COPD is anxiety and depression. In severe stages of the disease, characterized by respiratory failure, patients, due to physical weakness, are inactive and prone to depression. Changes in the psycho-emotional sphere are also related to the systemic effects of COPD. Along with this, several systematic reviews and meta-analyses have found that symptoms of depression are predictors of the subsequent development of coronary artery disease. It is also known that panic attacks increase the risk of cardiovascular events, generalized anxiety and phobias can worsen the course of existing CVD.
2) Thus, the literature data show a high prevalence of pathology of the cardiovascular system in combination with chronic obstructive pulmonary disease, against which atherosclerosis and anemia are formed. Obesity or cachexia, osteoporosis and depression.
3) In the presence of this combined pathology in patients, their direct effect on each other and the risk of developing a syndrome of mutual aggravation, the therapy of which becomes more complicated, are observed.

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